

Bachelor of Engineering (Civil Engineering)
[5th Year; 2nd Semester Examination - 2025]
Advanced Foundation Engineering

Total Time: Three Hours

Full Marks 100
(Part I: 50 + Part II: 50)

Use a separate Answer-Script for each part

Part I (50 Marks)

(Codes are NOT Allowed)

Answer all in brief and to-the-point (Assume any relevant data if not provided, but required)

- 1 Explain the behavior of expansive soil with respect to the mineralogical composition of soil. What can be adopted to overcome the possible problems that can cause problems in civil engineering structures due to shrinking-swelling characteristics of soils? Draw a typical well foundation indicating its components. Mention the types of caisson foundations along with their advantages and disadvantages with neat sketches. (5+5+5+5)
- 2 Mention the merit(s) and demerit(s) of an underreamed pile. (5+25)

A double under-reamed pile is constructed in medium stiff clay soil with the water table close to the ground surface. The average cohesion along the shaft and bottom are 60 kPa and 90 kPa, respectively. The diameters of the pile and the bulbs are 300 mm and 750 mm, respectively. The center of the first bulb is at 4.5 m below the ground surface, while the center of the second bulb is at 2.5 m below the center of the first bulb. Given the bucket length is zero, estimate the vertical compression and uplift capacity of the pile with adhesion factor 0.40. Compare the result a single bulb system (only the bottom bulb) with all other condition and dimensions remain the same. Draw neat figures for both the configurations.

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BACHELOR OF ENGINEERING (CIVIL ENGINEERING) EXAMINATION, 2025

(5th Year, 2nd Semester)

ADVANCED FOUNDATION ENGINEERING

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(50 marks for each Part)

(Use separate answer-script for each Part.)

PART II (50 Marks)

Answer all the questions (notations have their usual meaning and assume reasonable values of data, if not given):

Q. 1 (a) What do you mean by 'De-watering'? Discuss advantage and disadvantage of sump-pump method in dewatering system. To lower down the water table equivalent to a depth of H , according to release the excess pore water pressure, from the shallow depth, calculate rate of flow - total discharge - time required by a submersible pump of 80% capacity of rate of flow to withdrawn the water of either side of excavation for the zone of influence (L) only with sump pump method as shown in Fig1. Design must be for unconfined aquifer in single line slot system. Dimension for a' is 100m, B is 8m, b is 1m, H is 3m, h is 1.5m, $L_1=L_2=L=R$; e is 0.69, K is 10^{-4} m/s.

(b) Determine the number of deep well required for unconfined aquifer as shown in Fig 2 for lower down the water level up to a depth of pump level. Dimension for L is 120m, B is 50m, b is 1m, H is 55m, s is 40m, K is 10^{-4} m/s, n' is 0.40 with diameter of deep well 50cm, $(2+3+7)+5$.

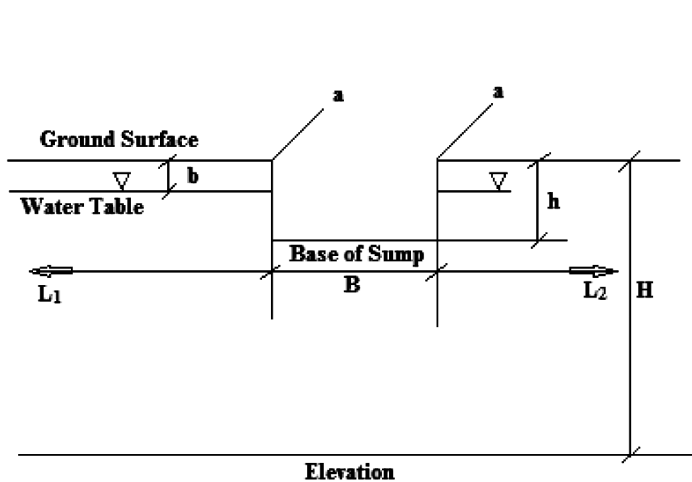


Fig 1.

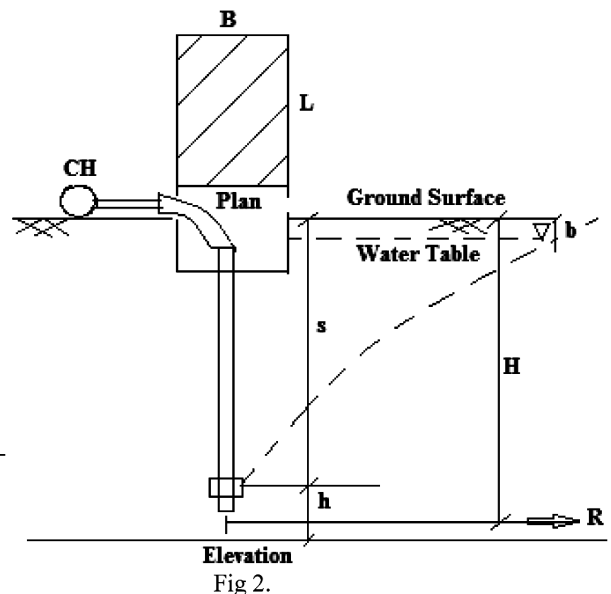


Fig 2.

Q. 2. What is 'Braced Cut'? For Kolkata, India deposit, in a site, a 12 m deep and 20 m wide cut is to be made in soft clay of un-drained strength of 24 KN/m^2 and unit weight of soil is 18.5 KN/m^3 . If first strut is placed at a depth of 2.0 m below ground level, consecutive struts at 4.0 m interval, find out reactions, forces in the struts and maximum bending moment in the wales. Check also the stability against bottom heave; consider the effect of tension crack. Assume, centre to centre horizontal spacing of struts as 3.0 m and N_c 6.8, $(2+10+3)$.

Q. 3 (a) Discuss general principles of machine foundation design?

(b) Check the adequacy of the machine foundation against the problem of resonance in vertical - horizontal direction and amplitude in vertical direction only for table given below. Calculate also the maximum amplitude. Assume, unit weight of concrete is 2.5 ton/m^3 and neglect coupling effect in rocking case, $(8)+(10)$.

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Machine Data and its foundation from Manufacturer:				
Element System Marked	Dimensions of Element, if Any			Weight (W _i)
(i)	L _{Xi} in meter	L _{Yi} in meter	L _{Zi} in meter	W _i in ton
Compressor	-	-	-	18.0
Motor	-	-	-	8.0
Top Block	4.50	4.75	1.60	?
Bottom Block	8.50	4.75	16.0	?
Speed of compressor 310 r.p.m., unbalanced vertical force 4.25 ton and rotary type machine of permissible amplitude 200 micron.				
Soil Data from Geo-technical Investigator:				
Sandy soil, C _u is 3.2×10 ³ ton/m ³ , C _τ is 1.25×10 ³ ton/m ³				